

# Identification of the Optimal Racing Line for Top Male Athletes on a Segment of a World-Cup Downhill Alpine Ski Slope using Tracking Data

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GNSS-tracking data are used in alpine skiing to investigate athlete's speed and acceleration as a standard. In this paper, we present a case study, in which we use GNSS-tracking data to identify additionally the racing line with the optimal geometric shape among 10 different racing lines chosen by elite athletes. For this, we concentrate on the famous S-curved segment (Brueggli-S) of the downhill FIS world cup track "Lauberhorn" in Switzerland. We have measured and analysed training runs, measured on a single day, of 10 world class athletes. The geometric shapes of each measured racing line share a similar pattern: The maximum curvature in the first curve is strongly correlated with the maximum curvature of the second curve. For the athletes under investigation, the overall best racing line is characterized by a defined ratio of the maximum curvature of the first to the second curve. We suggest that the observed correlation, as well as the optimal ratio of curvatures, is universal for a class of athletes with nearly identical performance levels. If and how this ratio varies for different classes of athletes (i.e. U10, U12 or U16 athletes) is an as yet unanswered question and remains open to further investigation

